

CHAPTER 6 -- MFL RECOVERY AND PREVENTION PLAN AND RESEARCH NEEDS

INTRODUCTION AND OVERVIEW

MFL Recovery and Prevention Strategy

Section 373.0361, F.S. requires that each regional water supply plan be based on at least a 20-year planning horizon and include (a) water supply and water resource development components, (b) a funding strategy for water resource development projects, (c) MFLs established within the planning region for identified priority water bodies, (d) development of a MFL recovery and prevention strategy, and (e) technical data and information supporting the plan.

Section 373.0421, F.S., requires that once the MFL technical criteria have been established, the Districts must develop and expeditiously implement a recovery and prevention strategy for those water bodies that are currently exceeding, or are expected to exceed, the MFL criteria within the 20-year planning time frame. Section 373.0421(2), F.S., provides the following, in relevant part:

The recovery or prevention strategy shall include phasing or a timetable which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions of this chapter.

Implementation Policies

Historical information provided in this report indicates that, over the past 10 years, the proposed minimum flow level (35 cfs) is exceeded approximately 25% of the time under current conditions. These low flow conditions occur frequently, such that an exceedance of the MFL criterion (flow less than 35 cfs for 20 days) occurred 34 times in 31 years or approximately once each year.

Review of existing information indicates the proposed MFL cannot be achieved immediately because of a lack of water conveyance infrastructure and regional storage facilities. These storage and infrastructure shortfalls will be overcome through construction of water resource and water supply development projects, improved conveyance facilities, and improved operational strategies that will provide increased storage and water delivery capabilities. Planning and regulatory efforts will, therefore, include a programmed recovery process that will be implemented over time to improve water supply and distribution to protect water resources and functions. The MFL Recovery Plan for the Northwest Fork of the Loxahatchee River includes many of the features that were developed for the *Northern Palm Beach County Comprehensive Water Management Plan* (NPBCCWMP) (SFWMD, 2002), the *Lower East Coast Regional Water Supply Plan* (SFWMD 2000c), and the *Comprehensive Everglades restoration Plan* (CERP) (USACE and SFWMD 1999). Appropriate technical analyses are also being conducted to determine the future water supply implications of the proposed MFL

technical criteria on urban and agricultural water users in the Loxahatchee River watershed. These results will be integrated into future updates of the *Lower East Coast Regional Water Supply Plan*, with appropriate implementation measures developed consistent with Section 373.0421 F.S. The Loxahatchee River MFL recovery plan consists of capital, regulatory and operational components.

Implementation Process

The SFWMD recognizes that additional water is necessary within the Loxahatchee River watershed to meet human and environment needs, today and in the future. The intent of the District, through its planning, capital improvement, operations, and regulatory programs, is to ensure that these requirements are met in an equitable manner. A cooperative effort is underway by FDEP, SFWMD, and other agencies, with public participation, to develop achievable restoration goals and objectives for the Loxahatchee River. In the meantime, the minimum flow criteria for the Northwest Fork that are proposed in this document will be achieved through a combination of structural improvements, enhanced operational protocols and regulatory activities.

The LECRWSP identified that additional planning was required to identify the amount of water needed to meet present and future demands within the SFWMD and develop sources as necessary to meet these needs. The goal of these planning efforts is to ensure that sufficient water is available for natural systems and consumptive uses during a 1-in-10 year drought condition. Projects that are described as part of the MFL Recovery Plan were developed in the *Lower East Coast Regional Water Supply Plan* (SFWMD 2000), the *Northern Palm Beach County Comprehensive Water Management Plan* (SFWMD 2002) and the *Comprehensive Everglades Restoration Plan* (USACE and SFWMD 1999) provide the facilities that are needed to meet or exceed the MFL criteria and may be sufficient to meet restoration requirements, once these have been identified. However, construction of these facilities will not be fully functional for several years.

The SFWMD has greatly improved its operational protocols for the river during the past twenty years to ensure that increasing amounts of water are delivered to the northwest Fork. These improved operations will continue to be implemented and will be enhanced as additional water becomes available.

The SFWMD, through its regulatory program, will ensure that groundwater and surface water resources are protected from harm and that appropriate water shortage plans are in place to protect water resources from harm and serious harm.

Finally, an adaptive management approach to resource management is proposed. Data collected from ongoing research and monitoring efforts will be used to measure system performance in achieving the proposed criteria and ecosystem responses. The criteria will be modified periodically, if necessary, to ensure that the goal of these efforts—to protect water resources from significant harm—is achieved.

MANAGEMENT TARGETS

The following resource management targets, which relate to providing increased flows to the Northwest Fork of the Loxahatchee River, are contained in the NPBCCWMP (SFWMD 2002):

- Provide supplemental water to maintain up to 65 cubic feet per second (cfs) flow over the Lainhart Dam to maintain appropriate salinities in the Northwest Fork of the River (the flow target that was established in the Plan).
- Provide supplemental water to the Loxahatchee Slough (headwaters of the Loxahatchee River) sufficient to maintain water levels that do not fall below the identified hydroperiod targets by more than six inches during normal years, and for no more than 30 days during drought periods with a return frequency of once every 10 years.
- Improve the timing and volume of flows provided from the other tributaries that discharge into the Northwest Fork.
- Meet current and projected future (2020) public, agricultural and industrial water supply; flood control; and environmental resource protection needs in northern Palm Beach County.
- It is the intent of the District, as outlined in the NPBCCWMP, to maintain water levels within the Loxahatchee Slough and meet the proposed 65-cfs flow target whenever possible. However under current conditions, there is not enough water storage capacity in the basin to consistently meet these objectives during dry periods. Review of USGS flow records over the last 10 years show that the 65-cfs flow target is met only 57 percent of time under current conditions.

The NPBCCWMP identifies nine major projects for improving conveyance and increasing storage in the basin to provide more water to the Slough and meet the 65-cfs flow target (see below).

In this document, it was determined that significant harm occurs to the river floodplain community when representative species that comprise this community fail to reproduce and survive to maturity, leading to a reduction in species diversity and alteration of the canopy structure. Once such changes have occurred, it may take many years for the forest structure to recover after proper hydrologic conditions have been reestablished. A baseline for resource protection was defined as the condition of the floodplain vegetation communities in 1984, at the time that the Northwest Fork was designated as a Wild and Scenic River. Based on these considerations, the SFWMD identified three possible management targets for this system, to protect existing resources against significant harm.

- Determine the downstream-most location of the existing “healthy” floodplain community where the critical species are successfully reproducing and the canopy structure is complete. Identify the conditions of salinity and flow that are needed to protect this community from significant harm.
- Determine the downstream-most location of a stressed but essentially intact floodplain community where canopy structure has been impacted but most of the species are still present but may not be reproducing. Identify the flow conditions needed to create a salinity exposure that is comparable to salinity conditions at the “healthy” community site and thus protect this stressed region from significant harm.
- Determine the downstream-most location of the remaining cypress community. Protect this community from significant harm by providing flows and salinity conditions that will ensure that this community remains viable by promoting recruitment, growth and maturity of new trees.

SFWMD staff initially attempted to develop MFL criteria based on protection of the

cypress community (SFWMD 2001). However, results of a scientific peer review determined that there was insufficient technical information available to support the proposed MFL. This revised proposal for MFL criteria is based on the second target as a more appropriate and scientifically-defensible basis to protect the resources of the Northwest Fork from significant harm.

Phased Recovery Plan.

Structural components of the recovery and prevention plan will be implemented in the form of a list of projects. The list will include the timing, funding requirements, and expected benefits for each project. The relevant water resource development projects and anticipated completion dates for phasing in these projects were identified in the NPBCCWMP (SFWMD, 2002) and are summarized in the next section. These projects will provide additional water to meet the proposed MFL target and water reservations.

Operational Protocols

The SFWMD will continue to implement existing operational protocols for facilities in this basin to meet requirements for flood control, water supply, environmental resources and water quality. In addition, the District will provide the MFL flow of 35 cfs and continue to provide flows of 65 cfs or greater from the Lainhart Dam to the Northwest Fork whenever water is available, consistent with the operational protocol currently in place. Once the necessary facilities have been constructed to provide a connection between the Loxahatchee Slough and the regional water delivery system that is linked to Lake Okeechobee, the District will have the ability to provide additional water to reduce or prevent the exceedance of MFL criteria.

Regulatory Components

The regulatory component for the Loxahatchee River considers specific modifications that are needed to address issuance of Consumptive Use, and Environmental Resource Permits in this watershed. In addition, the strategy addresses the implementation of water shortages and development of water reservations. Specific provisions regarding the regulatory components of the recovery and prevention for the Loxahatchee River are discussed beginning on page 155.

PHASED RECOVERY PLAN

The following provides a summary of the District's proposed phased MFL Recovery Plan for the Loxahatchee River and Estuary. Major Features of Phases 1-3 are shown in **Figure 33**.

Phase 1 (2002)

District staff will work to identify specific improvements that can be implemented during the next year to improve conveyance capacity by 20 to 50 cfs to the Northwest Fork during dry conditions, when water is available. The ability to provide water from the City of West Palm Beach's Water Catchment Area (Grassy Waters Preserve) to the Northwest Fork of the Loxahatchee River, without significantly lowering the stage within the Grassy Waters Preserve, is severely limited by the City's current pumping capacity from the L-8 Canal into the M-Canal (and subsequently into the Grassy Waters Preserve). Based on recent observations and depending on the severity of the dry conditions (normal dry season versus drought) the influent capacity only exceeds demands by 10 to 20 cfs. During this period the District will work with Palm Beach County and DOT to:

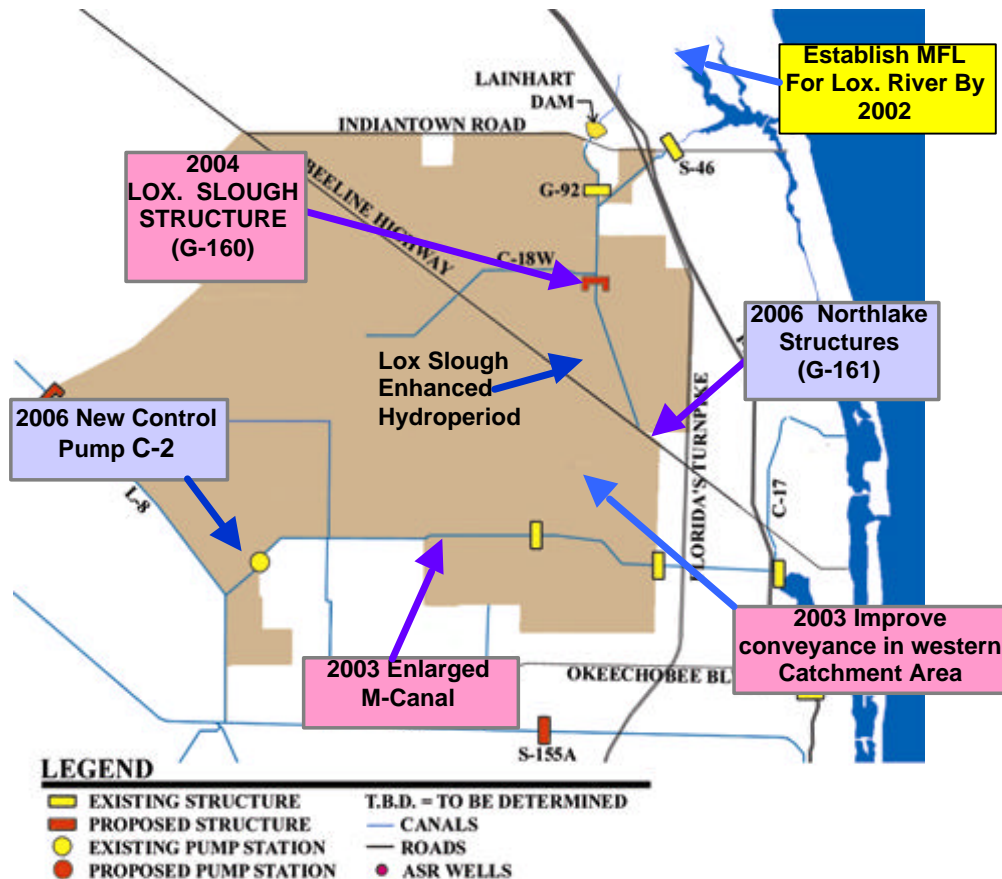


Figure 33. Loxahatchee MFL Recovery Plan, Phases 1- 3 (by 2006) (From: Northern Palm Beach County Comprehensive Water Supply Plan).

- Install new culverts under the entrance road into the Grassy Waters Preserve Southern Nature Center.
- Complete needed repairs to the Lainhart and Masten dams
- Perform maintenance consisting of removal of exotic vegetation, maintenance excavation and grading to clear out obstructions and allow approximately 20 cfs of flow from the eastern perimeter canal of the Grassy Waters Preserve to the three western 72-inch diameter culverts under North Lake Boulevard.
- Evaluate the constraints imposed by ground surface elevations, existing roads, existing buildings, and existing control structures on the ability to route water from the north side of North Lake Boulevard (at the existing three 72-inch diameter culverts and eastward) to the box culverts under the Bee Line Highway (SR 710). This includes evaluating both the constraints and conditions of Control 5 (controls flow of water from North Side of North Lake Boulevard to the East).
- Complete the L-8 Reservoir Pilot study

Phase 2 - Five Years (2002 through 2006)

Implement improvements to enhance flow capacity during both dry and wet conditions:

- Obtain permit and construct Loxahatchee Slough structure (G-160) to provide 5,000 acre-feet of additional capacity to improve hydrologic conditions in the Slough and store water for discharge to the Northwest Fork during the dry season.
- Install a new C-2 pump station and increase M-Canal conveyance capacity from L-8 basin to Grassy Waters Preserve by 450 cfs.
- As required, modify existing structures to provide conveyance and water quality enhancement (North of North Lake Boulevard) including:
 - Construct a spreader swale north and parallel to North Lake Boulevard
 - Remove, breach, or construct additional culverts through berms or other obstructions
 - Install new structures along Northlake Blvd (G-161) to provide up to 150 cfs to the Loxahatchee Slough and Northwest Fork. This will require building a structure and/or constructing an enhanced flow way and preferential flow path as needed, to accommodate dry and normal wet weather flows, as well as large storm water events to maintain the required level of drainage and flood protection, without significantly damaging the flow way area.
- As part of the Comprehensive Everglades Restoration Plan process, complete project management plans (PMP) and project implementation reports (PIR) for water supply projects that will provide addition flow and water storage capacity for the Loxahatchee watershed.

Phase 3 - Five Years (2011-2014)

Implement improvements that will substantially increase the sub-regional conveyance and storage capacities and provide the water distribution system required by both the CERP and the Lower East Coast Regional Water Supply plan (LECRWSP).

- Construct Grassy Waters Preserve perimeter canal improvements (2011)
- Install pumps to capture runoff from the J.W. Corbett Wildlife Management Area for storage within Loxahatchee Slough.
- Construct the L-8 reservoir to add 48,000 ac-ft of storage capacity to the water management system (2014)

Phase 4 - CERP (2002 through 2021)

Improvements to complete the development of sub-regional storage capacity to meet the year 2050 needs.

- Construct 10, 5-MGD local Aquifer Storage and Recovery (ASR) wells (50 MGD total injection capacity) to increase basin storage and reduce competition for surface water

Summary of Project Costs and Benefits

The costs and benefits of the nine key projects for increasing storage within the basin and

reconnecting the Loxahatchee Slough and Northwest Fork of the Loxahatchee River with the regional water supply system as described in the NPBCCWMP (SFWMD 2002) are summarized in **Table 41**. These projects also represent the District's proposed "MFL Recovery Plan" that are designed to meet the proposed MFL (35-cfs) over the next 5 years, and ultimately meet the District's proposed target flows (65-cfs) by year 2018. The total cost for implementing these projects is estimated at approximately \$39 million.

Table 41. Major projects, cost, benefits and completion schedule for projects that will provide additional water for the Loxahatchee slough and river (Source: SFWMD 2002).

Project Description	Cost (\$ Millions)	Benefit	Date
L-8 reservoir Pilot study & reservoir testing	\$3.5	Demonstrates reservoir feasibility of adding 3,500 ac-ft. of storage to system	2001
Northlake Blvd. Improvements (a) maintain 3, 72 inch culverts by 2002 (b) construct G-161 structure by 2005	\$0.1 \$1.2	Culvert maintenance provides 50 cfs to slough; G-161 adds up to 150 cfs to slough	2002 2005
C-2 Pump station (M-canal)	\$4.0	Adds up to 270 cfs conveyance to WPBWCA & slough	2005
M-canal widening	\$3.0	Provides up to 450 cfs of conveyance capacity to WPBWCA & Lox. Slough	2005
Construct Loxahatchee Slough Structure (G-160)	\$3.6	Adds 5,000 ac-ft. of storage to basin	2006
Grassy Waters Preserve perimeter canal improvements	TBD	Provides additional route to move water from WPBWCA to slough	TBD
Install pumps to capture J.W. Corbett WMA runoff for storage in Lox. Slough	TBD	Adds additional water to slough	TBD
Construct 10, 5MGD ASR wells	\$15	Increase basin storage and reduces competition for water during dry season	2010
Construct L-8 reservoir(s)	?	Adds 48,000 ac-ft of additional storage capacity	2018

Water Delivery Benefits of Proposed Projects

Table 42 provides a summary of output from these model simulations showing the relative improvements over time in the District's ability to meet both the 35-cfs and 65-cfs flow targets based on implementing these projects. The amount of water produced by these projects over time is represented in **Figure 34**.

Table 42. MFL Recovery Program showing incremental improvements in the District's ability to meet 35 cfs flow target (based on output from NPBCCWMP models).

Desired Flow target	1995 Base Case Without Improvements			2006 with G-160 + G-161 in place			2018 with LEC Plan and CERP Projects constructed		
	% time below target	No. Events	Avg. Duration (days)	% time below target	No. Events	Avg. Duration (days)	% time below target	No. Events	Avg. Duration (days)
65 cfs	59	389	5	30	155	6	0.8	4	6
50 cfs	54	273	5	19	138	5	0.6	3	6
35 cfs	49	296	5	6	35	5	0	0	0
20 cfs	44	256	6	1	15	2	0	0	0
10 cfs	20	177	4	<0.1	1	1	0	0	0
5 cfs	6	146	3	0	0	0	0	0	0
2 cfs	5	130	2	0	0	0	0	0	0

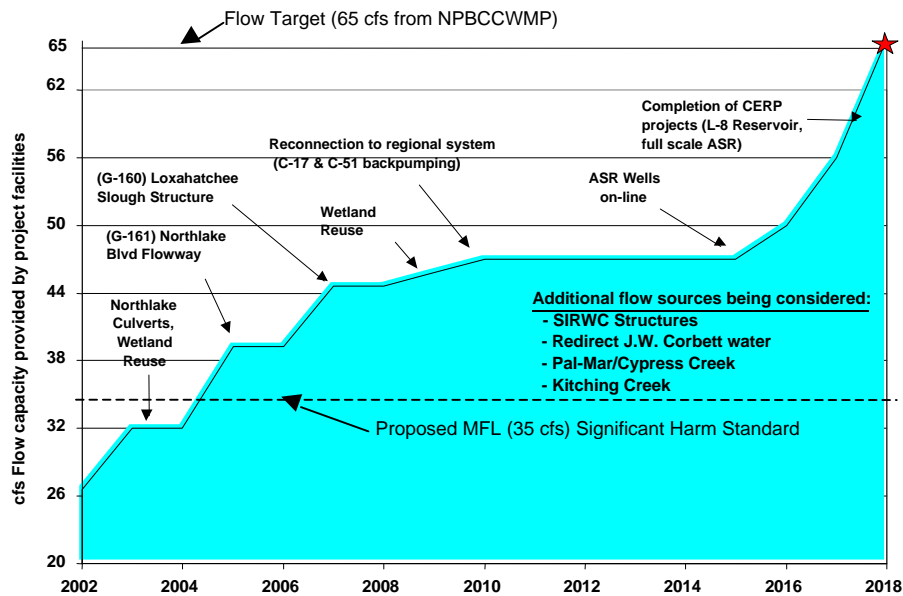


Figure 34. Conceptual representation of increase in flows to the Northwest Fork as projects in the NPBCCWMP and CERP are completed

EVALUATE OPTIONS TO OBTAIN WATER FROM OTHER BASINS

Pal-Mar/Cypress Creek and Hobe Groves

Cypress Creek/Pal-Mar and the Groves are two of the seven sub-basins in the Loxahatchee River watershed. These two basins occupy approximately 63 square miles (40,500 acres) in Martin and Palm Beach Counties. Cypress Creek and Hobe Groves Ditch discharge surface water from these basins to the Northwest Fork. The Cypress Creek/Pal-Mar Basin is made up of 86% native uplands and wetlands. A little over 10,000 acres of native uplands and wetlands are in public ownership in the Hungry Land Wildlife and Environmental Area. The majority of runoff from this basin moves through overland flow from west to east then discharges into the Ranch Colony Canal and Cypress Creek. The eastern portion of the basin has been significantly altered to accommodate agricultural and residential land uses. Citrus groves are the predominant land use in the Groves Basin, which is drained by the Hobe Groves Ditch and the Federation Canal.

Four agencies -- the SFWMD, Florida Fish and Wildlife Conservation Commission, the Florida Department of Environmental Protection and Martin County -- have teamed together, using SFWMD funds, to initiate a study of these areas. Many water resource related problems have been identified such as; (1) upstream movement of salt water in the Northwest Fork of the Loxahatchee River, (2) sediment loading in Cypress Creek and the Loxahatchee River, (3) flooding in Ranch Colony during severe storms, and (4) overdrainage in the Pal-Mar wetlands.

A set of models that represent the hydrologic and hydraulic processes in the Cypress Creek/Pal-Mar and the Groves Basins will be developed. The models will provide a basis for potential solutions to the current problems of the area, such as a) optimal management of the wetlands on the Pal-Mar property, b) possible diversion of flow from the C-44 Canal through Pal-Mar to supplement flow to the Northwest Fork; and c) identification and management of discharges from the Groves and Cypress Creek to the Northwest Fork.

Kitching Creek

Three projects are being considered by Martin County as follows, to provide additional water in this basin that could potentially improve flows to the Northwest Fork.

1. Kitching Creek Water Quality Improvement Project

The Kitching Creek Water Quality Improvement Project will enhance surface water flows to the Northwest Fork by raising average wetland water levels by as much as 2 feet over an area exceeding 1,000 acres located north of the Northwest Fork. Water table elevations in these wetland areas will be increased by a similar amount and will serve to increase the groundwater contribution to the Northwest Fork. These water management improvements are located in the vicinity of 138th Street and Bridge Road in Martin County, and extend south toward Jonathan Dickinson State Park. Benefits of this alternative are (a) rehydration of wetlands, (b) water quality improvement, (c) reduction of flood levels, and (d) return of portions of Kitching Creek to its predevelopment flowway (Earth Tech 2000).

This part of the overall project redirects Kitching Creek flows that currently travel to Jenkins Ditch and cause erosion and flooding. The flows will be redirected to the southwest through wetlands and into Kitching Creek's predevelopment flowway and to a wetland system located south of 138th Street. Flooding is reduced along 138th Street, Powerline Road, and Kitching Creek Road. These water management measures are accomplished by blocking existing culverts under Bridge Road and installing new culverts in different locations, possible re-engineering of a portion of Bridge Road, regrading existing drainage ditches and low quality wetlands to provide shallow, wide flowways, installation of stormwater treatment ponds, and installation of berms and other water control structures.

2. Kitching Creek East Tributary Diversion Berm

This water management improvement project is located in the vicinity of the intersection 138th Street and Powerline Avenue located in Martin County. Benefits of this alternative are rehydration of wetlands, reduction of erosion, and reduction of flooding. This portion of the project creates a diversion that redirects flows into the predevelopment flow way of Wilson Creek and away from populated areas along Powerline Avenue and Kitching Creek Road. This diversion is accomplished by blocking existing culverts at the intersection of Powerline Avenue and Bridge Road, installing a new culvert under Bridge Road east of the intersection, and providing a 2-ft. high berm to direct the water southeast toward Wilson Creek, within Jonathan Dickinson State Park.

3. Flora Avenue Area Improvements

Flora Avenue water management improvements extend approximately 8,000 feet southward from the intersection of Flora Avenue and Bridge Road. Benefits of this project component are improvements in the water quality flowing into Jonathan Dickinson State Park property south and east of Flora Avenue and decreasing the level of flooding of Flora Avenue residences and businesses. Reduced flooding along Flora Avenue will be accomplished by raising an approximate 2000-ft section of the roadway and providing a new water quality structure adjacent to Flora Avenue. Stormwater from developed areas along the road will be routed to detention ponds for attenuation and sediment removal prior to discharge to Jonathan Dickinson State Park.

OPERATIONAL PROTOCOLS

Interim Operating Procedures

During the next several years, while facilities are being constructed and more detailed operational plans for these facilities are being developed, the SFWMD will continue to operate regional facilities in the manner that has been used during the past ten years (1990 to 2001). During this period, discharges to the Northwest Fork have improved considerably relative to deliveries that were provided during the 1970's and 1980's. The average amount of water delivered to the Northwest Fork increased from 52 cfs in 1971-89 to 86 cfs during 1990-2001 (see **Table 25** in **Chapter 5**). These changes occurred in part due to modifications that were made to the conveyance canals and dams and the installation of automated water control structure at G-92 and in part due to increased rainfall in the basin. The result has been that the distribution of plant communities along the river has not changed significantly since 1984.

In addition, the District will continue provide flows of 50 cfs or greater from the Lainhart Dam to the Northwest Fork of the River whenever possible, consistent with the operational protocol currently in place. Generally, water is discharged from the C-18 through the diversion structure at G-92 depending on the relationship between water levels in the C-18 and the Northwest Fork at Indiantown Road. Water is diverted to the C-14 when (a) flows in the C-14 fall below 50 cfs; and (b) when levels in the C-18 exceed 12.5 feet NGVD (normal canal stage is 14.5 feet NGVD).

Examination of the historical record indicates, on average, that flows to the Northwest Fork are generally above 50 cfs, and even in the dry seasons the average flow during the period from 1971-2001 was 70 cfs. Average dry season flows may be as low as 26 cfs during major regional droughts such as occurred in 1989-90 and these problems cannot be fixed until additional storage and conveyance facilities are constructed.

Development of New Operational Protocols

Once the necessary facilities have been constructed to provide a connection between the Loxahatchee Slough and the regional water delivery system, the District will have the ability to deliver water to reduce or prevent the MFL criteria from being exceeded. Operational guidelines necessary for implementation of water supply deliveries to achieve MFLs, in concert with meeting other required water demands, will be identified as these facilities are designed and constructed.

DESIGN AND OPERATIONAL ISSUES THAT SUGGESTED FOR CONSIDERATION BY CONCERNED CITIZENS AND OTHER AGENCIES

A number of additional issues and concerns have been identified by the public and other agencies that need to be considered as part of future research and monitoring efforts, regulatory activities, CERP, and regional water supply planning processes. For the most part, these issues are beyond the scope of the MFL process for the Northwest Fork, but need to be considered by other related activities as they move forward. The issues are identified in **Table 43**, along with those activities or processes that should be used to address these concerns.

Table 43. Loxahatchee River design and operational issues and ongoing or future activities that should address these concerns.

Design/Operational Issue	Process or Activity to Address this Issue
Whether MFL's need to be established for all tributaries to the Loxahatchee River	Determination of restoration needs; LEC and UEC Water Supply Planning Process; MFL priority List
Determine the amount of water from the L-8 Reservoir that will be available for the Northwest Fork	Reservations of water; development of operational protocols for facilities
Potential purchase of agricultural lands that could be used as reservoirs	LEC and UEC Water Supply Planning Process; determination of restoration needs; CERP and RECOVER processes
Consider the purchase additional lands in the C-18, Pal-Mar or other basins for use as reservoirs or STAs	LEC and UEC Water Supply Planning Process; CERP and RECOVER processes
Use the Reese/Gildan flow-ways and shallow lakes as a reservoir (bleed down only to control)	Development of operational protocols for facilities
Examine opportunities to use water from local developments, with appropriate treatment to meet OFW standards, to enhance flows to the Northwest Fork.	Surface water management/ERP permitting
Send water from Corbett Area to the C-18 Canal for the Northwest Fork	CERP planning process; reservations of water; development of operational protocols for facilities
Increase storage on the Dupuis Reserve to be sent to the Northwest Fork	CERP planning process; reservations of water; development of operational protocols for facilities
Create a reservoir in the C-51 Basin to be sent north to the Northwest Fork	CERP planning process; reservations of water; development of operational protocols for facilities; NPBCCWMP/ LECRWSP Implementation)
Establish a hydrologic connection from the C-44 Basin through Pal-Mar to provide for storage, treatment and discharge of water into the Northwest Fork.	CERP and RECOVER processes; IRL feasibility Study; UEC Water Supply Planning process
Develop facilities needed to store water in the Kitching Creek basin	CERP planning and RECOVER processes; UEC Water Supply Planning process)
Allocate water from new storage facilities for use by the Northwest Fork, depending on availability	NPBCCWMP Implementation; CERP process; reservations of water; development of operational protocols for facilities
Buld future reservoirs should be built on disturbed properties rather than pristine lands	LEC and UEC Water Supply and CERP processes
The benefits and impacts of salinity barriers should compared with the benefits and impacts of constructing reservoirs	Determination of restoration water needs; LEC and UEC Water Supply Planning; and CERP planning

REGULATORY COMPONENTS OF THE MFL RECOVERY AND PREVENTION STRATEGY

The objective of the regulatory component is to protect the Northwest Fork from unacceptable consumptive use impacts while the capital and operational components of the Recovery Plan are implemented. In addition to the MFL recovery plan, a restoration effort will be underway with leadership from FDEP. Regulatory considerations in support of the restoration

efforts will include protecting reserved water supplies from consumptive uses and continuing to impose water quality protection criteria on projects that will discharge water to the Northwest Fork of the Loxahatchee River.

Consumptive Use Provisions/MFL

During the period while these facilities are being constructed, the District intends to issue and renew Consumptive Use Permits in a manner that will balance the needs of the environment with the needs for Public and agricultural water supply. CUP applications that propose to withdraw water directly or indirectly from the Loxahatchee watershed, that meet the conditions for permit issuance in Part II of Chapter 373, F.S., the District's Water Use **Basis of Review**, and 40E-20, F.A.C. as applicable, and are consistent with the approved recovery and prevention strategies under Section 373.0421, F.S., will be permitted. These permit applications will be reviewed based on the recovery and prevention strategy approved at the time of permit application review.

Existing or proposed consumptive uses that influence the Loxahatchee River shall be regulated consistent with the provisions contained in District rules 40E-2, 40E-8, 40E-20 and 40E-21 F.A.C., for MFL water bodies under recovery. Copies of these rules can be obtained by mail from the SFWMD or downloaded from the SFWMD website at www.sfwmd.gov. A copy of the MFL rule, Ch. 40E-8 F.A.C., is included in **Appendix L**.

Specific MFL criteria regarding the Loxahatchee River will be formally incorporated into the District rules by Governing Board action consistent with rule making procedures. These criteria will include the following:

1. The definition of the Loxahatchee River: The area of the water body where the MFL criteria will apply (e.g. the River bed that occurs between specific mile markers that are defined in the rule).
2. The MFL criteria consisting of the threshold flow rate, the location of the flow measuring point, the maximum duration that the flow may fall below without exceeding the criteria, and the frequency beyond which will result in significant harm (e.g. [as currently proposed] 'a flow of less than 35 cfs which persists for more than 20 days and occurs more frequently than once every 6 years).
3. A reference to the approved recovery plan (included in this document).

These three parts of the rules will help define where the special CUP criteria will apply and identify the elements of the recovery plan that address project water available for recovery. In addition these rule criteria establish under what conditions MFL recovery plan provisions apply versus when other prevention and restoration criteria apply.

Water Shortage Plan Implementation

Water shortage rules for the Loxahatchee basin should be substantially the same as those currently set forth in Chapter 40E-21. If necessary to prevent the MFL criteria from being exceeded, demand management cutbacks for recovery during drought conditions will be identified, to the extent that water withdrawals are causing the MFL exceedance (e.g., phased water shortage restrictions to prevent significant or serious harm). When a drought occurs, the SFWMD will rely upon the Water Shortage Plan to address regional water availability. Water shortage restrictions will be imposed as required by District rules, on the direct or indirect

withdrawals from a MFL water body if a MFL exceedance occurs or is projected to occur during climatic conditions more severe than a 1-in-10 year drought, to the extent that consumptive uses contribute to such exceedance.

During such drought circumstances, the District will equitably distribute available supplies to prevent serious harm to the water resources, pursuant to Sections 373.175 and 373.246, F.S., and the District's Water Shortage Plan, Chapter 40E-21, F.A.C. The Water Shortage Plan utilizes a phased cutback approach with the severity of use restrictions increasing commensurate with increased potential for serious harm to the water resources. The water shortage rules implementing the recovery strategy for the Loxahatchee will be substantially the same as those that apply to other recovery areas, such as the Everglades and Caloosahatchee.

Restoration Components for the Northwest Fork

In addition to the MFL, rules that protect the Loxahatchee River from further withdrawals that would cause significant harm, water supplies developed for restoration of flows to the Northwest Fork must also be protected. This will be done through the adoption of water reservations. As contemplated in the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000c), an initial reservation of existing flows would be established by rule. This initial reservation would consist of variable flows, which would be determined by the existing basin configuration, its response to rain and drought, and the need to protect fish and wildlife. Existing legal uses are protected from the reservations in so far as they are not contrary to the public interest. As new water resources development projects are constructed and operated, the amount of water made available for restoration from that project will be added to the reservation while the remaining portion of the project water made available for consumptive use will be available for allocation.

Environmental resource permits are required when land use changes result in discharge of storm water for flood protection or otherwise impact environmentally sensitive lands. The rules governing these permits are contained in SFWMD rules 40E-4 F.A.C. Within these rules are special criteria relating to the water quality of storm waters discharging to Outstanding Florida Waters (contained in Ch. 62-302 F.A.C.F.A.C.). These higher levels of treatment requirements and permit protections are applied to new projects which discharge to the Loxahatchee River, which has been established as an Outstanding Florida Water (OFW).

In addition to enhanced water quality standards for waters that discharge to the River, environmental resource/surface water permits address drainage. Currently, each project is developed such that the rate of discharge that occurred off the land prior to development is equivalent to the rate of discharge after the project. These "pre-versus-post" criteria can also be applied to the volume stored on the project. Within the Loxahatchee watershed, where additional storage is needed, volume-based criteria could be beneficial to the Loxahatchee River. However, the expense of providing this extra storage is significant and may not be cost-effective. An evaluation of a "pre-versus-post" volume permit criteria for lands that discharge to the Loxahatchee River or its tributaries should be undertaken to determine if the cost of implementing these criteria would produce beneficial improvements to the hydrology of the Northwest Fork.

Water Reservations

Legal Description

Section 373.223(4), F.S., provides the following in relevant part:

The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety.

The statute also provides that reservations are subject to periodic review based on changed conditions. This provides flexibility to account for changes in implementation strategies and contingency plans during the next 20 years. A specific level of protection is also provided to existing legal users when establishing reservations. Existing legal users are protected insofar as they are “not contrary to the public interest” (Section 373.223(4), F.S.).

Development and Implementation

Water reservations for the Loxahatchee River will be developed and implemented consistent with reservations for the other restoration areas covered by the CERP. Currently, the policy and technical approach for CERP reservations is under development. The first reservation of existing water for the Loxahatchee River should be made within one year after Governing Board approval.

ADAPTIVE MANAGEMENT OF THE LOXAHATCHEE RIVER AND ESTUARY

Based on best available information, a minimum flow has been proposed for the Northwest Fork, with the understanding that more information is needed to refine assumptions used in criteria development. Ongoing and proposed research and monitoring efforts in the Loxahatchee River, estuary and watershed are designed to provide data to fill gaps in our understanding of the ecosystem. Research and monitoring efforts will be targeted to the VEC approach, based on the freshwater floodplain community, as presently proposed, and potentially to consider other resources in the river and estuary. This information will be incorporated into the next generation of hydrodynamic, salinity, watershed and ecological models now under development. Improved models will provide SFWMD staff with an opportunity to reevaluate the proposed criteria and refine the Northwest Fork MFLs in accordance with regional water supply plan development and implementation activities

Research Needs

The criteria developed in this document should be used as the basis for SFWMD rule development and to incorporate monitoring of the MFL criteria as a factor to be considered in the issuance of Consumptive Use Permits, both individually and cumulatively, within the LEC Planning Area and, more specifically, within the Northern Palm Beach County water supply planning area.

The following provides a summary of proposed research projects needed to refine or verify the proposed MFL criteria for the Loxahatchee River and estuary. In the development of this document, District staff relied primarily on existing monitoring and research data to identify technical relationships among flow, salinity and observed impacts to the river’s biological resources. The research projects listed below are proposed over the next several years to

collectively evaluate and/or refine the proposed MFL flow target and duration criteria as necessary.

These criteria will need to be reviewed, and perhaps revised, as: 1) additional data becomes available through future research and monitoring projects; 2) prevention and recovery strategies are implemented; 3) environmental conditions may change over time (i.e. due to sea level rise or climate change), or 4) additional experience is gained through refined modeling. The following additional research and monitoring projects should be considered for future refinement of the MFL criteria for the Loxahatchee River. These studies have also been specifically identified by Loxahatchee regulatory agencies and interest groups, as necessary for future management efforts:

- **Refine MFL Criteria.** Develop a 3 year research plan that will (a) evaluate and or refine the proposed MFL flow target and develop a new target as necessary, (b) refine the proposed minimum duration criteria, and (c) identify other potential VECS in the river and estuary to complement the use of floodplain vegetation. Develop a research plan that will provide a science-based estimate the number of days that water levels may remain below the proposed MFL without impacting the upstream communities.

A major focus of this research will be to identify a science-based estimated number of days that surface water flows in the Northwest Fork can remain below the proposed minimum flow target, without causing significant harm to the upstream river and floodplain communities. Furthermore, the proposed projects will provide information that can be utilized by regulatory agencies to make informed decisions regarding the effects of the existing and proposed modified hydrologic regimes, on the natural system of the River, and potential future management efforts. The following provides a summary of proposed research projects recommended by staff for fiscal year 2002-2003 to refine or verify proposed MFL criteria for the Loxahatchee River and Estuary.

- **Salinity Barrier Feasibility Analysis.** Model the feasibility of installing a salinity barrier within the Northwest Fork to prevent saltwater intrusion of the upstream river system during dry periods (2002) and determine the effects of such a barrier on salinity and water quality. The barrier may be permanent, temporary, fixed or adjustable. If the feasibility study warrants construction of a barrier, engineering plans for construction of the barrier will be developed (2003).
- **River Restoration.** Develop a long-term, feasible, restoration plan for the Loxahatchee River and estuary that addresses ecosystem management goals and objectives of the Wild and Scenic River, Jonathan Dickinson State Park and aquatic preserves in the estuary and adjacent waterways. An open process that involves all of the major agencies, environmental interests and the public will be developed and used to determine the appropriate enhancement goals for the River. The restoration should be based on rainfall-based water delivery system model for the Loxahatchee watershed that develops surface water flow requirements from all major tributaries and groundwater inflow.
- **Estuary Research.** A major assumption in the development of the MFL was the use of the Valued Ecosystem Component (VEC) method to establish the MFL based on protection of upstream freshwater communities. Additional information is needed to determine the effect of the proposed minimum flow regime on the nursery function and extent of oligohaline habitat as well as other downstream estuarine or marine species. During the next fiscal year, District staff will review and analyze existing water quality and biological

data collected from the river to elucidate relationships between river flow and biological response. Additional monitoring may also be necessary to measure the effect of the proposed MFL on these resources.

Watershed Modeling. Develop a watershed management plan, incorporating elements of this report, the *Wild and Scenic River Management Plan* (SFWMD 2002) and the *Watershed Action Plan* (FDEP, 1998) for all tributaries that drain into the Loxahatchee River system, including determination of whether MFLs should be established for these tributaries and/or groundwater inflows. This plan will be initiated by expanding the current Basin Assessment and Hydraulic/Hydrologic Study of Cypress Creek/Pal-Mar and the Groves project to develop a Cypress Creek Basin watershed model, that could be utilized for other drainage basins within the Loxahatchee Watershed. This watershed modeling effort would be the first step to: 1) develop a sub-regional hydrologic model that addresses existing Water Use Permits for the Loxahatchee Watershed and their effect on providing minimum flows for the Northwest Fork; 2) provide hydrologic studies of drainage basins that discharge to the Loxahatchee River, to determine which basin is the best source of water to provide minimum flows to the River and Estuary; and 3) determine the relationship between the Northwest Fork, Loxahatchee Slough and the surficial aquifer.

Monitoring Program

- **Ground Water/Soil Salinity Monitoring.** Develop a research program that will investigate the relationship between the movement of saltwater into the cypress forest floodplain groundwater system, quantify and map soil salinity within the river floodplain, establish river wetland plant species salinity and duration tolerances, install water quality monitoring wells and fund a groundwater quality monitoring program within the cypress forest floodplain that will measure groundwater salinity in relationship to Northwest Fork flows.

Groundwater and soil monitoring stations should be established within the floodplain of the Northwest Fork to identify locations of saline groundwater and soil, and to quantify the amount of saline contamination. Data collected from this monitoring will be specifically correlated with other river monitoring and research data (i.e. flow data and surface water, salinity data, vegetative data) to refine the relationships between flow, salinity and the cypress wetland community.

In addition, efforts will be increased to monitor groundwater levels during dry periods as part of the current saltwater intrusion monitoring program. These data can be used as a basis to implement water restrictions when it can be measurably shown that a particular consumptive use has the potential to impact the resource.

The purpose of these efforts is to collect additional data that can be used to a) provide better estimates of groundwater flow to the river at critical points in the watershed, b) refine the interactive groundwater/surface water model that is presently being developed, and c) identify “hot spots” that could potentially impact the slough or the river during dry periods.

Upon adoption of the proposed MFL, the SFWMD would initiate a review of the existing monitoring network, add monitoring stations where deemed appropriate, and establish performance measures that can be used to determine whether observed changes in ground

water condition during declared drought periods are having significant effects on the Loxahatchee River.

As part of this monitoring program, SFWMD staff may also review pumpage data provided by major users for major wells and wellfields. These data provide a means to determine whether water restrictions are needed within the basin or whether utilities or other uses should implement cutbacks or shift withdrawals away from problem areas.

- **River Corridor Vegetation Monitoring.** The SFWMD will develop a research and monitoring program to more thoroughly investigate the relationship between the upstream movement of the saltwater wedge and adverse impacts to the floodplain community on the Northwest Fork and Kitching Creek. The program will establish permanent vegetation transects to document and identify vegetative species salinity level and duration tolerances; how different salinities affect physiology; growth and recruitment; and the short-term and long-term change(s) in relation to flow and salinity. The feasibility of using tree ring analysis to determine historical salinity conditions in the river will be evaluated. Data collected from this monitoring will be specifically correlated with other monitoring data (i.e. flow, surface water, groundwater, soil, and salinity data) to refine the relationships between flow, salinity and freshwater wetland communities in the Northwest Fork
- **Tributary Flow Monitoring.** Additional water level and flow monitoring needs to be implemented within the basin to provide additional data for the models and to document the effectiveness of SFWMD management actions in terms of maintaining appropriate flows to the river. Besides monitoring of levels and flows at G-92 and Lainhart Dam, water flows and levels should be monitored at other points along the river, including flows and upstream and downstream levels at control structures on Cypress Creek and Hobe Grove ditch, water level and flow data for Kitching Creek near the confluence with the Northwest Fork and perhaps at one or two other locations in the main stream of the River between river mile 6 and river mile 9.

As part of the MFL monitoring network, install real-time flow monitoring gages for each major tributary that drains into the Northwest Fork of the river. Gages are already operational for G-92 and the Lainhart Dam. Additional telemetry gages may need to be installed to monitor flows from Cypress Creek, Hobe Grove Ditch, Kitching Creek and Jupiter Farms

Flows at the Lainhart Dam currently fall below the proposed significant harm standard of 35 cfs about 25% of the time (on average 6-7 events/yr. with an average duration of 15 days). Water management structures (culverts/riser boards) that provide surface water hydrologic connections between the river/slough and adjacent properties may have to be closed during critical periods to avoid over drainage of Loxahatchee Slough. Monitoring is needed to determine whether the MFL criteria are being achieved and how much additional flow can be provided that will help meet restoration goals and objectives for the river.

- **Water Quality Monitoring.** Monitor salinity at the (i) the confluence of Kitching Creek and the Northwest Fork of the river (river mile 8.1) and (ii) at a site located approximately one mile up river (river mile 9.1), or whatever point is most appropriate as agreed to by FDEP and SFWMD staff. Expand routine water quality monitoring network to include Loxahatchee River tributaries and address water quality monitoring needs associated with

river restoration and determination/monitoring of Total Maximum Daily Loads for critical parameters.

Adaptive Management Operational Strategy

A possible interim operational strategy for releasing water from G-92 to downstream areas of the Northwest Fork, during the next four years before additional storage facilities are online, might include the following components:

Components

- a. During dry periods, data provided from water level gages, flow data and salinity monitoring data can be used by SFWMD operations staff to release water from G-92 only as needed to provide supplemental flow to the river as needed to maintain salinity at the desired level
- b. If significant flows are occurring from other tributaries, flows from G-92 could be reduced proportionally. Such a reduction in flow will allow additional water to be effectively stored in the Loxahatchee Slough to be released later in the dry season.
- c. During extremely dry periods, flows from G-92 will be managed to maximize the time that flows above 35 cfs can be delivered to the Northwest Fork (this may extend the time that Phase I and Phase II restrictions are imposed and may reduce the likelihood and duration of Phase III restrictions).

Benefits

- The proposed basin-wide MFL research monitoring program and the installation of additional real-time monitoring gages will provide additional data required to model the performance of this watershed, manage and conserve water during drought periods and protect the Northwest Fork against significant harm.
- Provides information needed to assess the ability of operational and regulatory strategies to protect the resource.
- Provides additional incentives to move forward with Loxahatchee Slough, Grassy Waters Preserve and L-8 Basin improvements.
- Provides additional time and data necessary to identify restoration needs and develop plans.
- Implementation of the proposed adaptive management strategy is especially important during the next four years, while additional facilities are being constructed to store and deliver more water.